WISCONSIN ENDANGERED RESOURCES REPORT 21

Changes in the Status and Distribution of Wisconsin Double-crested Cormorants, 1973-85: Resurgence and Recovery of a State Endangered Species

by Sumner W. Matteson

SUMMARY

The Wisconsin double-crested cormorant nesting population has increased from 66 pairs (3 colonies) in 1973 to 2,217 nesting pairs (22 colonies in 14 counties) in 1985. This increase amounts to an average annual growth rate of about 38%. Young production, though underestimated, has ranged from 0.86 to 1.66 with an overall mean of 1.22 young per nesting pair. Cormorant nesting populations have recovered from pesticide contamination, human persecution, and habitat loss. Probable major factors responsible for the cormorant recovery include a relative decline in DDE levels since the late 1960s, recruitment, immigration, the installation of artificial nesting platforms at selected sites (794 at 11 sites; 57% of available platforms used in 1985), and increased legal protection coupled with an educational campaign to inform the public about the status of the species. Despite the recovery, recent incidences of crossed bills and other gross physical abnormalities in Lake Michigan cormorants and other colonial waterbirds raise concerns about future reproductive impairments associated with microcontaminants. Also, increasing use of pound nets by cormorants in Lakes Superior and Michigan may prove intolerable to commercial fishermen who may decide depredation permits and abatement techniques are insufficient for controlling this species, once it is delisted.

Recommendations include: 1) annual monitoring of known colony sites to assess changes in nesting numbers and productivity; 2) periodic maintenance of nesting platforms and installation of new platforms if feasible; 3) listing the species as threatened if the statewide nesting population falls below 500 pairs for 3 consecutive years; 4) researching and utilizing appropriate abatement techniques prior to consideration of other control measures; and 5) periodically collecting a sample of eggs and deformed young from selected colonies for contaminant analyses.

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A Report to the Wisconsin Natural Resources Board
by Sumner W. Matteson
Bureau of Endangered Resources
Wisconsin Department of Natural Resources
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Abstract

From the early 1920s to the mid-1960s nesting double-crested cormorants (Phalacrocorax auritus) occupied a total of 17 known colony sites in 16 counties, though apparently no more than 7 colony sites were active during a single breeding season. The total number of nesting pairs statewide reached at least several hundred in peak years. Between the mid-1950s and early 1970s habitat loss and deterioration, human disturbance, and pesticide contamination combined to threaten the species with extirpation from the state. The double-crested cormorant was listed as a state endangered species in 1972. In 1973 only 66 known pairs occupied 3 colony sites. During 1973-85 the nesting population increased dramatically to 2,217 pairs at 22 colony sites in 14 counties. In 1982 the state status of the double-crested cormorant was officially changed to "threatened." It is recommended now that the double-crested cormorant be deleted from the Wisconsin Threatened Species List.

Methods

Field data on colony sizes and productivity during 1973-85 were recorded by Bureau of Endangered Resources staff, DNR wildlife managers, U.S. Fish and Wildlife Service personnel, University of Wisconsin biologists, and private researchers. As a rule estimates of nesting pairs were based on the highest number of active nests counted during a single visit (Milton and Austin-Smith 1983), although for frequently visited colonies the maximum number of nests maintained at any one time provided an estimate of the minimum number of nesting pairs present (Postupalsky 1978). Nest counts usually occurred during the peak of the nesting season, which varied from late May to mid-June. Not all active colonies were censused annually. Population estimates during 1973-85 nevertheless provide an index to the magnitude of population changes. Estimates of numbers of young fledged from all colonies were incomplete each year and as represented are underestimates for annual net production statewide. Young included in productivity estimates were age 3 weeks or older, or were observed flying.

Results and Discussion

Wisconsin's nesting double-crested cormorant population has experienced a resurgence twice during this century. First, between 1920 and the mid-1950s and more recently between the early 1973 and 1985. Data prior to the early 1970s is scant so that the actual peak number of nesting pairs is highly speculative.

The first resurgence occurred in response to protection from extensive market gunning, which was especially prevalent in the 1880s and 1890s. There are no published reports of cormorants nesting in Wisconsin during the first 19 years of this century (Matteson 1983). From 1920 to 1966 cormorants colonized a total of 17 different sites in central and northeastern Wisconsin, though apparently no more than 7 sites were active during a single breeding season. Observations of several thousand migrants were common during the spring and fall in the 1940s and early 1950s (Anderson and Hamerstrom 1967).

Three factors contributed to the species subsequent demise: 1) long-term habitat deterioration in the form of tree losses and stand thinning; 2) renewed human persecution, especially unsanctioned control measures undertaken by commercial fishermen off the Door County Peninsula in northeastern Wisconsin (Nest trees, ground nests, eggs, and young were destroyed because fishermen believed cormorants frequenting pound nets and other nets posed a serious threat to their livelihood. In central Wisconsin illicit cormorant shoots became popular.); and 3) reproductive failures associated with the effects of chlorinated hydrocarbon residues, particularly DDT (dichlorodiphenyltrichloroethane) and its metabolites DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) (Anderson and Hamerstrom 1967, Anderson et al. 1969, Postupalsky 1971, 1978, Matteson 1983).

By 1966 only 3 colony sites with a total of 24 nesting pairs were known to be active (Anderson and Hamerstrom 1967). In 1972 the double-crested cormorant was officially designated a state endangered species. In 1973 a statewide survey conducted by Postupalsky and Sindelar (BER files) revealed that only 66 nesting pairs occupied 3 colony sites in central, south central, and northwestern Wisconsin (Figure 1): Grand River Marsh Wildlife Area (WLA), Mead WLA, and Crex Meadows WLA. An encouraging sign, however, was that 2 of 3 colonies active in 1966 were still active in 1973 and had grown in size. In northwestern Wisconsin the Crex Meadows colony grew from 7 to 23 nesting pairs and at the Mead WLA the number of nesting pairs increased from 5 to 20. At a colony closely associated with Mead WLA (Lac DuBay) there were 300 nesting pairs in 1949 before the colony's gradual decline. A review of the species' changing status and distribution is provided in Figures 1-5, representing 3-year intervals from 1973 through 1985.

By 1976 there were 4 new colony sites. The Crex Meadows colony was no longer active; instead nesting cormorants apparently relocated to the Fish Lake WLA in southwestern Burnett County. For the first time in nearly 28 years nesting cormorants returned to island sites off the Door County peninsula. And for the first time in 35 years cormorants nested in the Wisconsin waters of the Mississippi River at what is now the Trempealeau National Wildlife Refuge. The total number of nesting pairs in 1976: 128 in 6 colonies (Figure 2).

By 1979 the number of nesting pairs statewide increased to 435 at 9 colony sites (Figure 3). For the first time in 21 years cormorants nested in the Wisconsin waters of Lake Superior: a colony of 17 pairs became established in 1978 on Gull Island of the Apostle Islands (Stanley Temple, pers. comm.) and increased to 41 nesting pairs in 1979 (Matteson 1979).

By 1982, 5 more colonies had emerged in central Wisconsin alone. There were also a total of 5 colonies in Lake Michigan waters. The state's nesting population stood at 1,028 pairs in 16 colonies (Figure 4). Due to the species apparent comeback its official state status changed from "endangered" to "threatened." By 1985 the state's nesting population had reached 2,217 in 22 colonies, with additional colonies appearing in Green Bay, off the Door County peninsula, on the Mississippi River, in the Apostle Islands, and in central, north central, and northwestern Wisconsin (Figure 5 and Table 1).

Since 1973 the state's nesting population has experienced an average annual growth rate of about 38%. This trend is represented by Figure 6. A comparison of the distribution of colonies in 1973 and 1985 is presented in Figure 7.

Natural groupings of colonies in 1985 can be associated with major lakes, rivers, watersheds, and wetlands (Figure 8): 51% of the nesting population occurred in Green Bay and in Lake Michigan waters off the Door County peninsula; 19% occurred near the Wisconsin River and associated areas; 14% occurred in the Apostle Islands; 10% occupied sites in or near Horicon Marsh and Grand River Marsh area; and the remaining 6% colonized sites on or not far from the Mississippi and St. Croix rivers.

Statewide, young production during 12 years of the 13-year period, though incomplete and conservatively estimated for most colonies, ranged annually from a mean of 0.86 to 1.66 young per pair, with an overall mean of 1.22 young per nesting pair. Dunn (1975) reported that annual productivity of 1-2 young per pair was necessary to maintain cormorant population stability.

Increases in the state's double-crested cormorant nesting population between 1973 and 1985 statistically fits both exponential and sigmoidal or logistic growth models (Mike Staggs, pers. comm.). Fitted to the logistic model (Figure 9), extrapolation of the nesting data projects Wisconsin's population stabilizing at ca. 3,249 nesting pairs by 1995. This assumes that certain parameters, such as recruitment rates, remain constant. Density dependent factors, such as competition with great blue herons and gull species for nesting sites, and limited food resources and nesting habitat, theoretically will assert themselves around 1990.

The largest body of nesting data comes from the Mead WLA in central Wisconsin, where active management has been largely responsible for increases in nesting pairs since 1974. The Mead WLA is 26,610 acres in size, with 17 large impoundments created principally for waterfowl management (Meier 1981). Cormorants have occupied two flowages: Berkhahn Flowage and Teal Flowage. The number of pairs at Mead increased from 20 in 1974 to a peak of 429 in 1984. Mean fledging rates have ranged from 1.27 to 2.85 young per pair (Table 2).

The increase in nesting pairs at Mead is largely attributable to the installation of artificial nesting platforms. In February and March during 1974-76, the DNR installed 126 artificial nesting platforms on used utility poles to replace fallen or unstable nest trees. Poles were placed in bottom clay soils at least 6.5 ft in depth where water depths were no more than 4.5 ft. Approximately 1.5 x 1.5-ft holes were cut in the ice with a chain saw. An hydraulic auger mounted on the back of a truck drilled holes into the clay bottom. Depths were 4.5, 6.0, and 6.5 ft for poles 17, 30, and 35 ft in height, respectively. A bulldozer placed each pole into the clay layer and most poles were placed within 25 ft of natural nesting trees (Meier 1981).

The platform design that proved successful was a lath structure containing a 7-ft -long perch. Sticks were wired to the lath as "seed" for a nest. By 1985 a total of 352 platforms had been installed at Mead. In 1974 26% of cormorant nesting pairs utilized the platforms. By 1985 83% (330) of all active nests at Mead occurred on the platforms. The mean number of young per successful nest on the platforms was 2.58 in 1974, 1.18 in 1975, 2.83 in 1976, and 2.58 in 1979 (Meier 1981, Goller 1979). Young production was generally greater on platforms than at natural nesting sites (Meier 1981).

There are presently 794 nesting platforms at 11 sites in Wisconsin and 57% of these contained active nests in 1985. (For a report on the condition and use of these platforms see Matteson 1985); this represented about 21% (455) of the total number of active nests in the state in 1985. Another 42% (929) of cormorant nests occurred on the ground (cobble-gravel beaches, rock shelves), 26% (580) were in live trees, and the remaining 11% (253) were in snags.

The use of artificial nesting platforms is one factor that has contributed to the present double-crested cormorant resurgence in Wisconsin. Other probable major factors include: immigration--an apparent influx of out-of-state breeding adults supplementing indigenous nesters; recruitment--from established colonies within the state; a relative decline in DDE residue levels between the late 1960s and early 1980s; increased legal protection coupled with an educational effort to inform the public about the status of the species; and a plentiful food supply.

The current nesting population level of 2,217 pairs exceeds any recorded for the species during a single breeding season. And with colonies in 14 counties (Table 1) the species has never been more widely distributed during a documented nesting season. The breeding status of double-crested cormorants is presently secure and continued mention of the species on the Wisconsin threatened Species List is no longer warranted.

Tangential Cautionary Notes

In recent years incidences of cormorant young and other colonial waterbirds that have developed crossed bills and other gross physical abnormalities at Lake Michigan colonies (Kubiak 1983 a,b; Heinz et al. 1985) have raised concerns about the extent of biological dysfunctions associated with concentrations of polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). PCDDs and PCDFs are composed of the highly toxic 2,3,7,8-tetrachlordibenzo-p-dioxin (TCDD) and 2,3,7,8-tetrachloro-dibenzofuran (TCDF) as well as other p-dioxins and furans (Stalling et al. 1985). Concentrations of TCDDs in fish and birds are greatest near hazardous waste sites or where chlorinated organic chemicals are produced (Stalling et al. 1985) and yet few studies have been conducted to determine PCDF and PCDD residue levels in fish and fish-eating birds. Data on the impacts of dioxin on fish and birds are unknown.

A recent study of nesting Forster's terns (Sterna forsteri) by Harris et al. (1985) indicated that reproductive impairments were associated with concentrations of 2,3,7,8-TCDD, its isosteres, and PCBs at levels known to cause such impairments. More studies on the relationships between poor reproductive success, associated reproductive behaviors, and contaminant levels are needed to assess further the contaminant threats to nesting colonial waterbirds on Lake Michigan. The minimum required effort would be to monitor reproductive success annually at Forster's tern and common tern (Sterna hirundo) colonies, and at cormorant colonies where possible, and to archive for future analysis a sample of eggs and deformed young from selected sites.

In regards to impacts on commercial fisheries, complaints about cormorant depredation of lake whitefish (Coregonus clupeaformis) detailed by Matteson (1983), is an issue that may gather momentum as cormorant populations continue to increase and more fishing operations are affected. Despite Craven and Lev's (1985) research indicating that Apostle Islands' cormorants feed mainly on small forage species such as ninespine stickleback (Pungitius pungitius), slimy sculpin (Cottus cognatus), spoonhead sculpin (Cottus ricei), and burbot (Lota lota), commercial fishermen believe cormorants frequent pound nets regularly in the Apostle Islands as well as on Lake Michigan and cause significant whitefish losses. According to Esther Lev (pers. comm.), cormorants are attracted initially to pound net structures as perch sites where they can sun themselves and dry their wings. Apparently cormorants cause fish losses when they pursue fish below their perching sites. Entering the pound net pot, cormorants chase fish, which disperse and become gilled in the mesh of the net. The gilled fish cannot be sold fresh but instead have to be smoked and sold at a loss (Bruce Swanson, pers. comm.).

In 1985 five commercial fishermen from Lakes Superior and Michigan submitted depredation claims totalling $13,849.67 for whitefish losses. That figure is likely to range between 10 and 20 thousand dollars annually assuming minimal or no abatement techniques are employed.

Craven and Lev (1985) generally found that abatement techniques at Apostle Islands' pound nets were effective for periods up to 4 weeks before cormorants habituated to them. They tested 9 techniques (Table 3) and found that certain scare devices (scarecrow/dummy) combined with devices or techniques (cones, nails, electric shocker) made pound net poles unattractive and proved most successful in deterring the birds. Their experiments covered 1 1/2 summers and provide a data base from which research should continue.

Once the double-crested cormorant is delisted, commercial fishermen may apply to the U.S. Fish and Wildlife Service for depredation permits to control cormorants that cause losses. If depredation permits do not meet the needs of fishermen they may take matters into their own hands if they see no other recourse. This could possibly mean unsanctioned visits to cormorant colonies possibly resulting in large-scale losses, a major contributing factor to the species demise in the Great Lakes region during the early and mid-twentieth century (Matteson 1983).

Recommendations

1. Annual monitoring of known colony sites should continue indefinitely to determine annual changes in the number of nesting pairs and in productivity, and to allow for an assessment of population stability or threats to the species.

2. Existing artificial nesting platforms should be maintained periodically, and in locations where nests occur in deteriorating or dead timber consideration should be given to the installation of poles with artificial nesting platforms to replace or supplement natural nesting sites.

3. If the Wisconsin nesting population of double-crested cormorants falls below 500 pairs for 3 consecutive years the species once again should be placed on the Wisconsin Threatened Species List and an assessment performed to determine remedial actions.

4. If cormorants at pound nets and other nets on Lakes Michigan and Superior constitute a threat to the livelihood of commercial fishermen, appropriate abatement techniques should be utilized prior to the consideration of other control measures. An investigation to determine the most cost-effective and suitable abatement technology available is needed. Research should continue to field test abatement techniques at selected sites on Lakes Michigan and Superior.

5. A sample of cormorant eggs and young should be collected periodically from colonies where incidences of gross physical abnormalities have been known to occur or egg failures observed so that analyses can be performed to determine organochlorine residue levels and the magnitude of threat posed by contaminants to nesting cormorants.

Summary

The Wisconsin double-crested cormorant nesting population has increased from 66 pairs (3 colonies) in 1973 to 2,217 nesting pairs (22 colonies in 14 counties) in 1985. This increase amounts to an average annual growth rate of about 38% and is characteristic of a density-independent pattern reflecting exponential growth. Approximately 51% of the nesting population occurred in Green Bay and Lake Michigan; 19% near the Wisconsin River and associated areas; 14% in the Apostle Islands; 10% in or near Horicon Marsh and Grand River Marsh; and 6% on or not far from the Mississippi and St. Croix rivers. Young production, though underestimated, has ranged from 0.86 to 1.66 with an overall mean of 1.22 young per nesting pair. Cormorant nesting populations have recovered from pesticide contamination, human persecution. and habitat loss. Probable major factors responsible for the cormorant recovery include a relative decline in DDE levels since the late 1960s, recruitment, immigration, the installation of artificial nesting platforms at selected sites (794 at 11 sites; 57% of available platforms used in 1985), and increased legal protection coupled with an educational campaign to inform the public about the status of the species.

Despite the recovery, recent incidences of crossed bills and other gross physical abnormalities in Lake Michigan cormorants and other colonial waterbirds raise concerns about future reproductive impairments associated with microcontaminants. Also, increasing use of pound nets by cormorants in Lakes Superior and Michigan may prove intolerable to commercial fishermen who may decide depredation permits and abatement techniques are insufficient for controlling this species, once it is delisted.

Recommendations include: 1) annual monitoring of known colony sites to assess changes in nesting numbers and productivity; 2) periodic maintenance of nesting platforms and installation of new platforms if feasible; 3) listing the species as threatened if the statewide nesting population falls below 500 pairs for 3 consecutive years; 4) researching and utilizing appropriate abatement techniques prior to consideration of other control measures; and 5) periodically collecting a sample of eggs and deformed young from selected colonies for contaminant analyses.

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Table 1. 1985 POPULATION STATUS OF THE DOUBLE-CRESTED CORMORANT IN WISCONSIN

County	Location	Adult Population Estimate	Active Nests	Young Produced[a]
	Apostle Islands National Lakeshore			
Ashland	Gull Is. T51N R1W S12	578	289	500
Bayfield	Eagle Is. T51N R6W S31	26	13	15
	Fish Lake WA			
Burnett	Grettum Flowage S37N R19W S10/11	58	29	0
Burnett	[c]Unnamed lake T37N R18W S20	16	8	3
Taylor	Chequamegon Waters Flowage[1] T31N R3W S14	30	15	ND
Clark	Sportsman's Lake T29N R2W S24	4	2	1
	Mead WLA			
Marathon	Berkhahn Flowage T26N R6E S29	654	327	600
Marathon	Teal Flowage T26 R5E S23	138	69	125
	McMillan Flowage			
Marathon	McMillan West T26N R4E S13/14	14	7	ND
Oconto	[c]South Oconto Marsh T28N R22E S21	16	8	ND
	Lake Michigan/Green Bay			
Door	Fish Island T34N R31E S28	38	19	23
Door	Gravel Island T32N R29E S15	332	166	172
Door	Spider Island T32N R29E S33	910	455	729
Door	Jack Island T31N R27E S7	142	71	ND
Door	Green Island T30N R25E S20	6	3	ND
Brown	Cat Island T24N R21E S7	826	413	ND
Jackson	CWCA T21N R1E S10	22	11	9
Buffalo	Trempealeau NWR T15N R10W S9	150	69	175
Green Lake	Grand River Marsh WLA T14N R11E S5/6	136	68	ND
Green Lake	[c]Lake Puckaway T15N R11E S26	20	10	ND
Dodge	Horicon NWR T13N R15E S25/30	300	150	ND
	Voths Lake			
Crawford	Ambrough Slough T8N R7W S35	35	15	16
Totals and Past Status				
1985		4,451	2,217	2,368
1984		4,083	1,905	2,760
1983		3,934	1,695	2,813
1982		2,408	1,028	882
1981		2,176	955	991
1980		1,638	819	867
1979		860	430	576
1978		697	345	321
1977		361	164	209
1976		307	128	121
1975		244	85	85
1974		213	97	93
1973		132	66	—

KEY

[a] - Incomplete data — at some sites no census of young occurred.
[c] - Incipeint colony in 1985; no prior records of cormorants nesting at this location.
[1] - Also referred to as Miller Dam Flowage.
ND - No data.

4515N

Table 2. Number of Nesting Pairs and Young Produced at the Mead WLA, 1973-85.

Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Nesting Pairs	20	39	41	51	67	118	124	218	235	315	361	429	396
Young Produced*	--	93(2.38)	52(1.27)	121(2.37)	191(2.85)	229(1.94)	254(2.05)	522(2.39)	490(2.08)	721(2.29)	675(1.87)	834(1.94)	725(1.83)

*Mean number of young produced per nesting pair is provided in parentheses.

Table 3. Results of Abatement Techniques Tested in the Apostle Islands, 1983-84 (From: Craven and Lev 1985)

Technique	Location	Trial Period	Results
Av-Alarm (audio scare device)	Madeline Island	1 week	Not successful. Cormorants observed perching within 7 feet of speaker. Also poor public acceptance in populated areas.
Electric-shocker (electrified wires)	South Twin Island Rocky Island Sand Island Little Squaw Bay Raspberry Bay	2 months	Successful at keeping cormorants from perching.
Metal cones (on tops of poles)	Raspberry Bay	1 month	Successful at keeping birds off poles. Best used in combination with another technique to keep birds off the rest of the net.
Nails (same purpose as cones)	South Tin Island Rocky Island Sand Island	2 months	Successful at keeping birds off poles. Best used in combination with another technique to keep birds off the rest of the net.
Owl decoy (scare device)	Raspberry Bay Raspberry Island	2 days	Unsuccessful. Birds observed perching next to decoy within 2 days.
Mylar helium balloons (scare device)	Frog Bay Hermit Island	2 weeks	Unsuccessful alone. Best used in conjunction with scarecrow.
Hanging scarecrow	Roy's Point Raspberry Bay South Twin Island		Successful for 1 month. After 4 weeks birds were observed perched on poles.
Boat (floating in pot of net)	Hermit Island	3 weeks	Successful for 2 1/2 weeks. Best used in conjunction with scarecrow.
Scarecrow/Boat	Cat Island Kapunky Bay Rocky Island	6 weeks	Successful. No birds observed at net for five weeks. Reduced gilling rate. Best used in combination with metal cones and mylar helium balloons.

FIGURE 1. Relative abundance and distribution of Wisconsin double-crested cormorant nesting pairs, 1973.

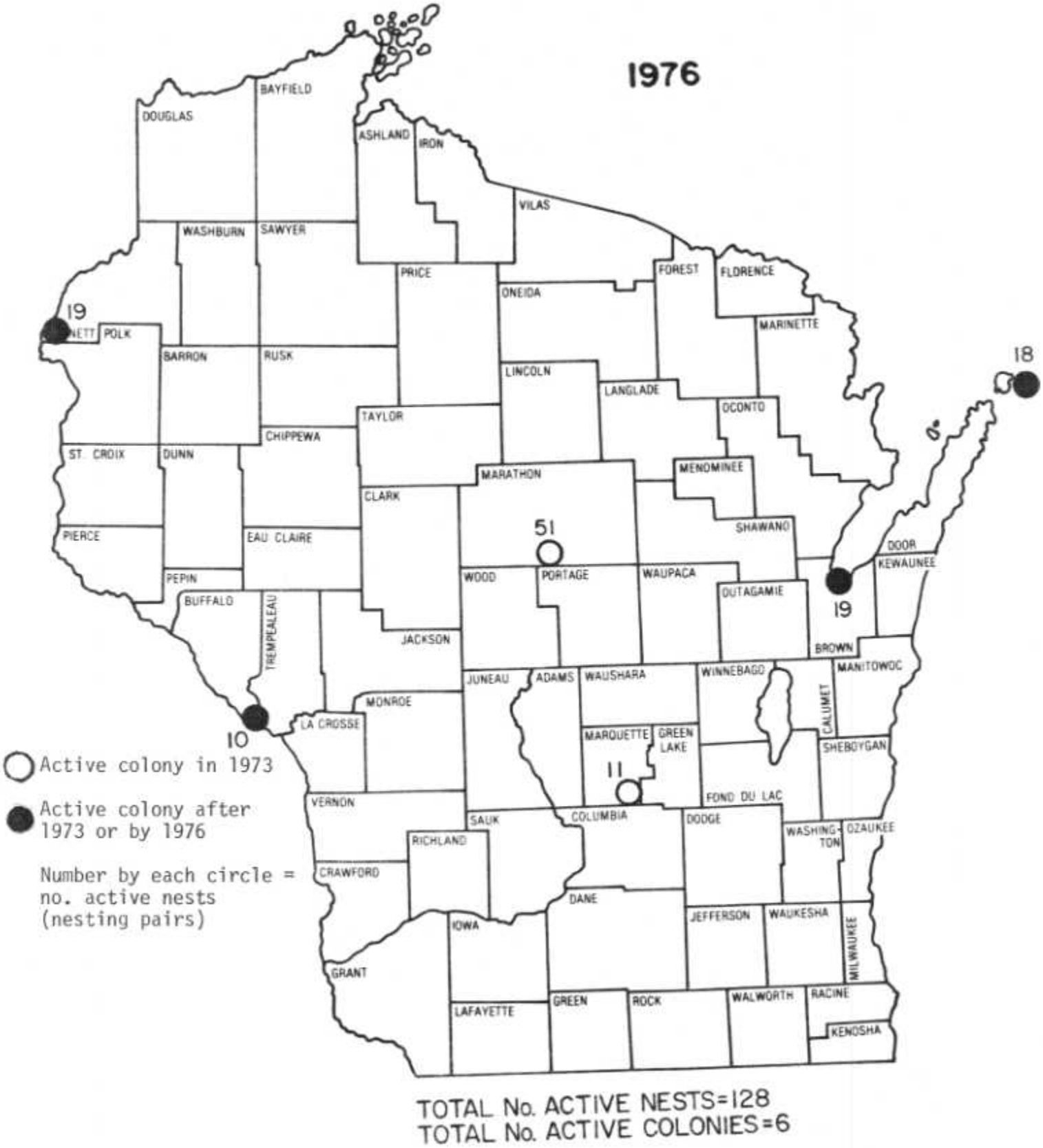


FIGURE 2. Relative abundance and distribution of Wisconsin double-crested cormorant nesting pairs, 1976.

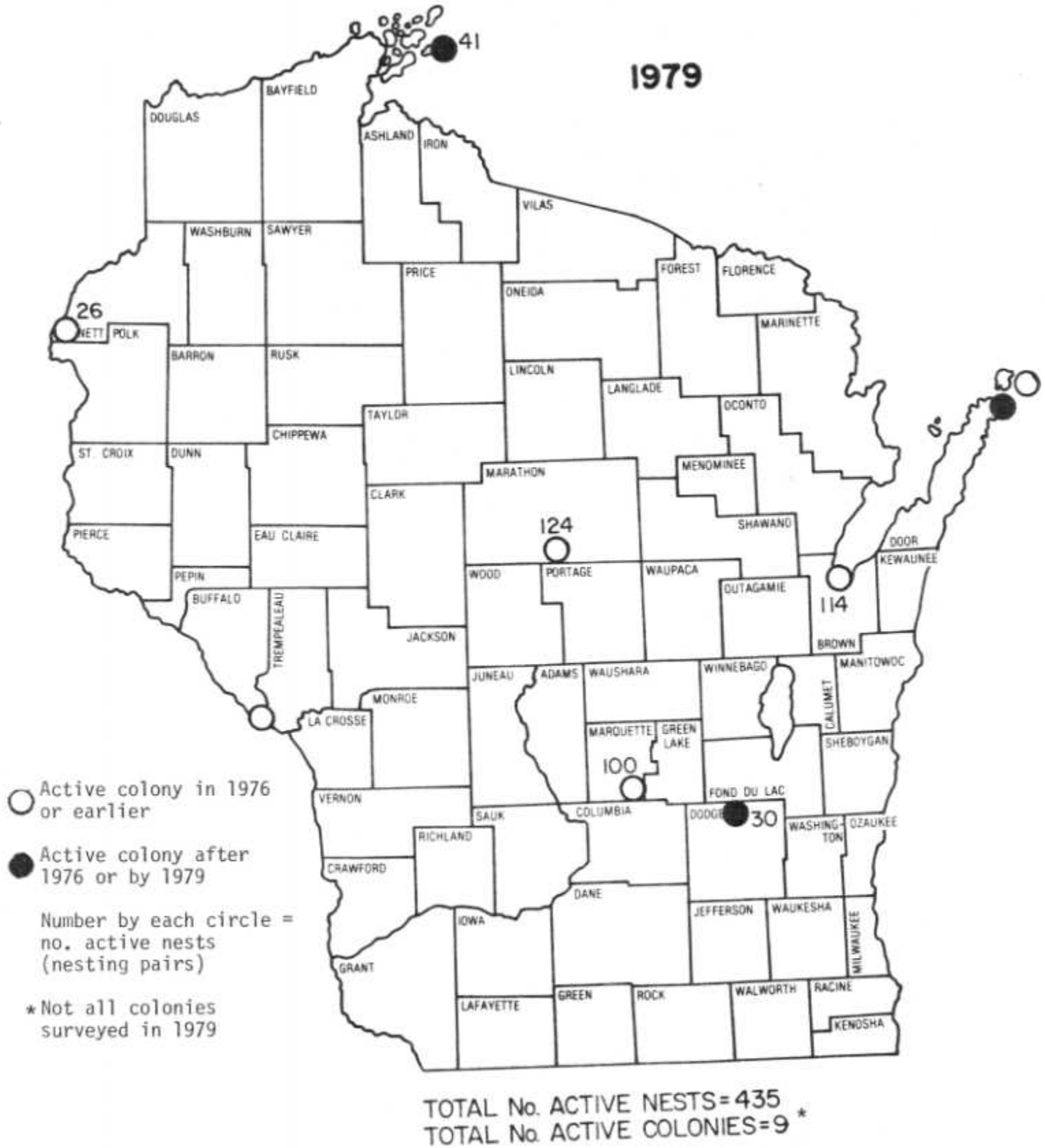


FIGURE 3. Relative abundance and distribution of Wisconsin double-crested cormorant nesting pairs, 1979.

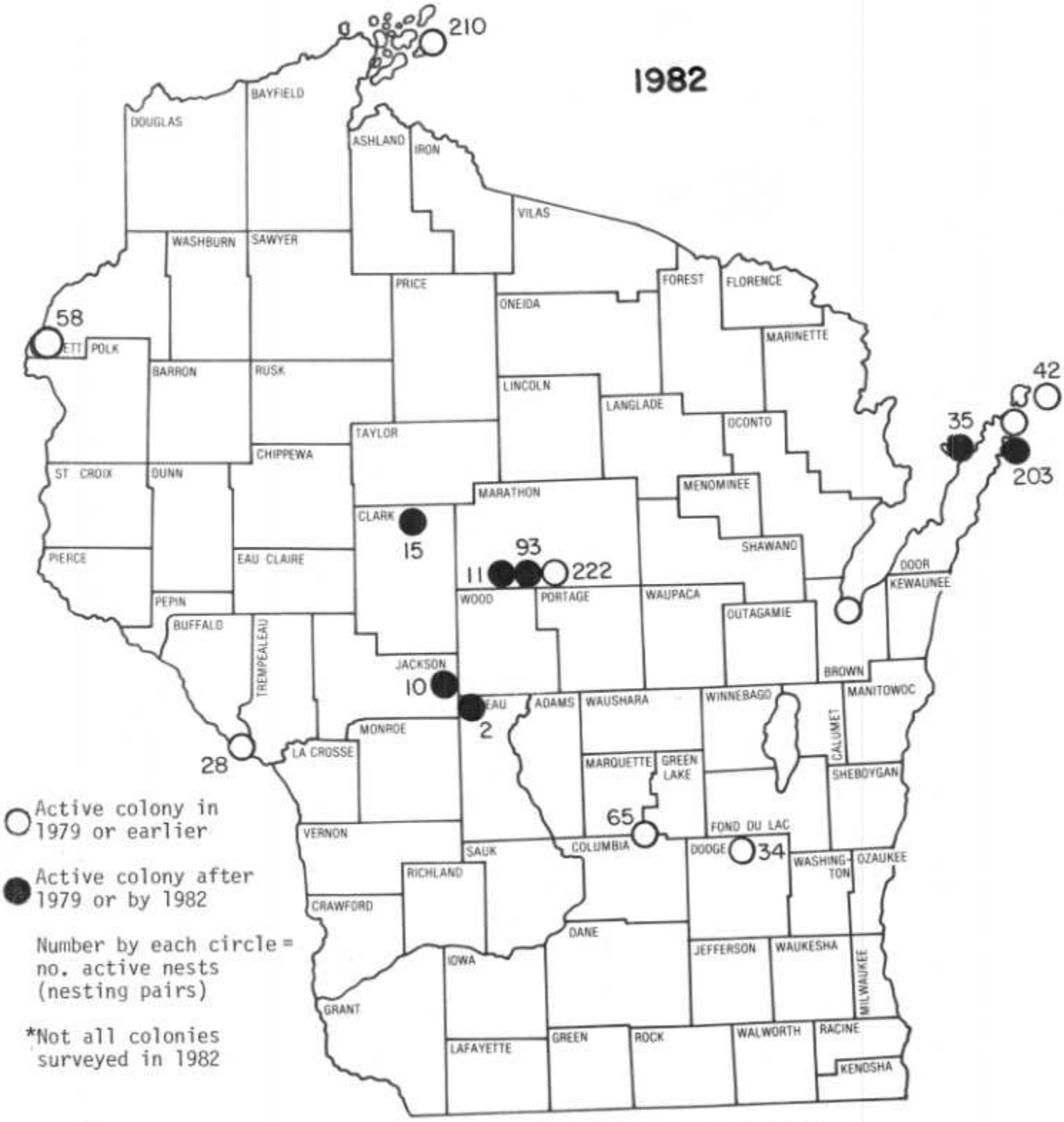
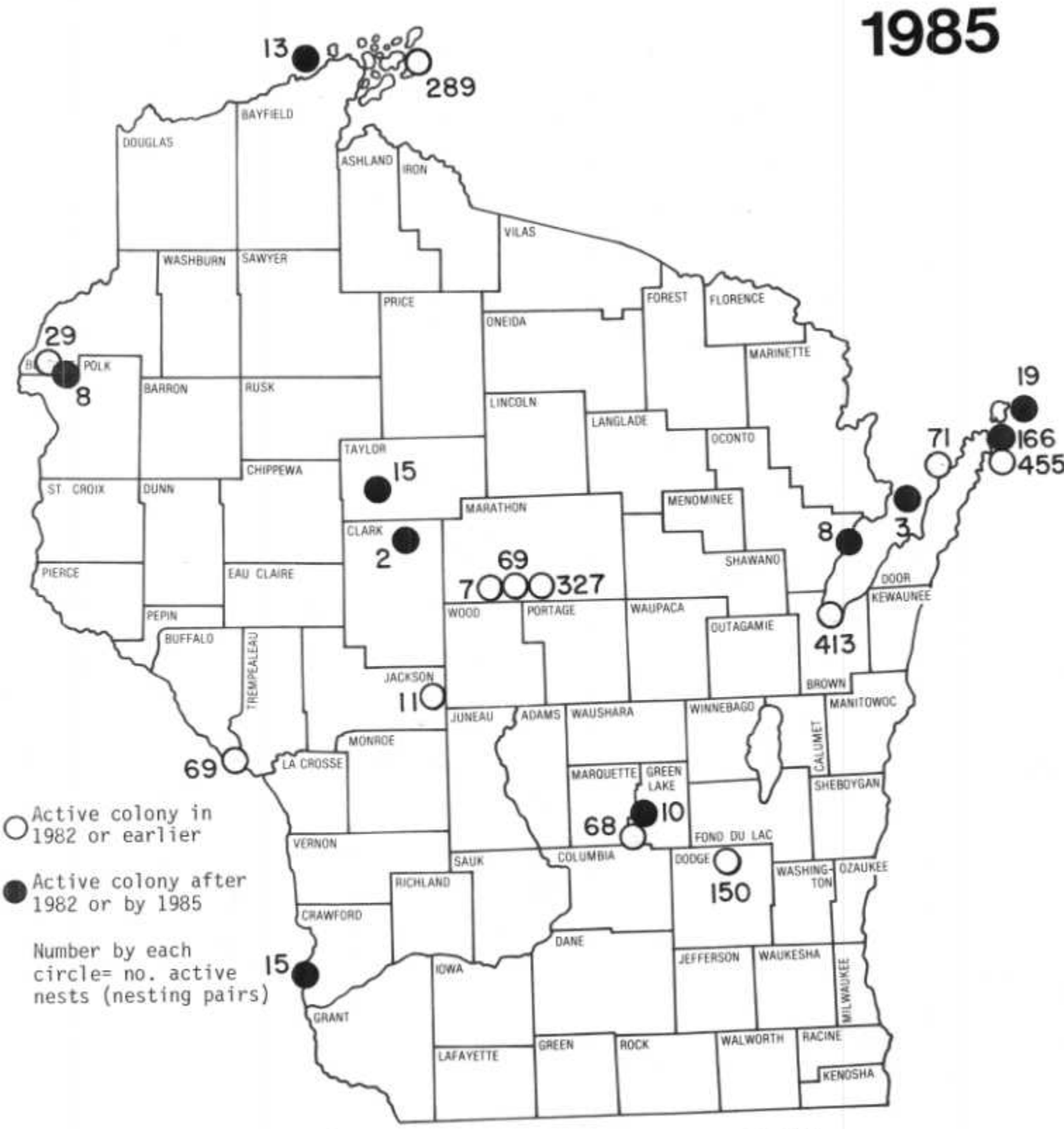


FIGURE 4. Relative abundance and distribution of Wisconsin double-crested cormorant nesting pairs, 1982.



TOTAL No. ACTIVE NESTS = 2,217
TOTAL No. ACTIVE COLONIES = 22

FIGURE 5. Relative abundance and distribution of Wisconsin double-crested cormorant nesting pairs, 1985.

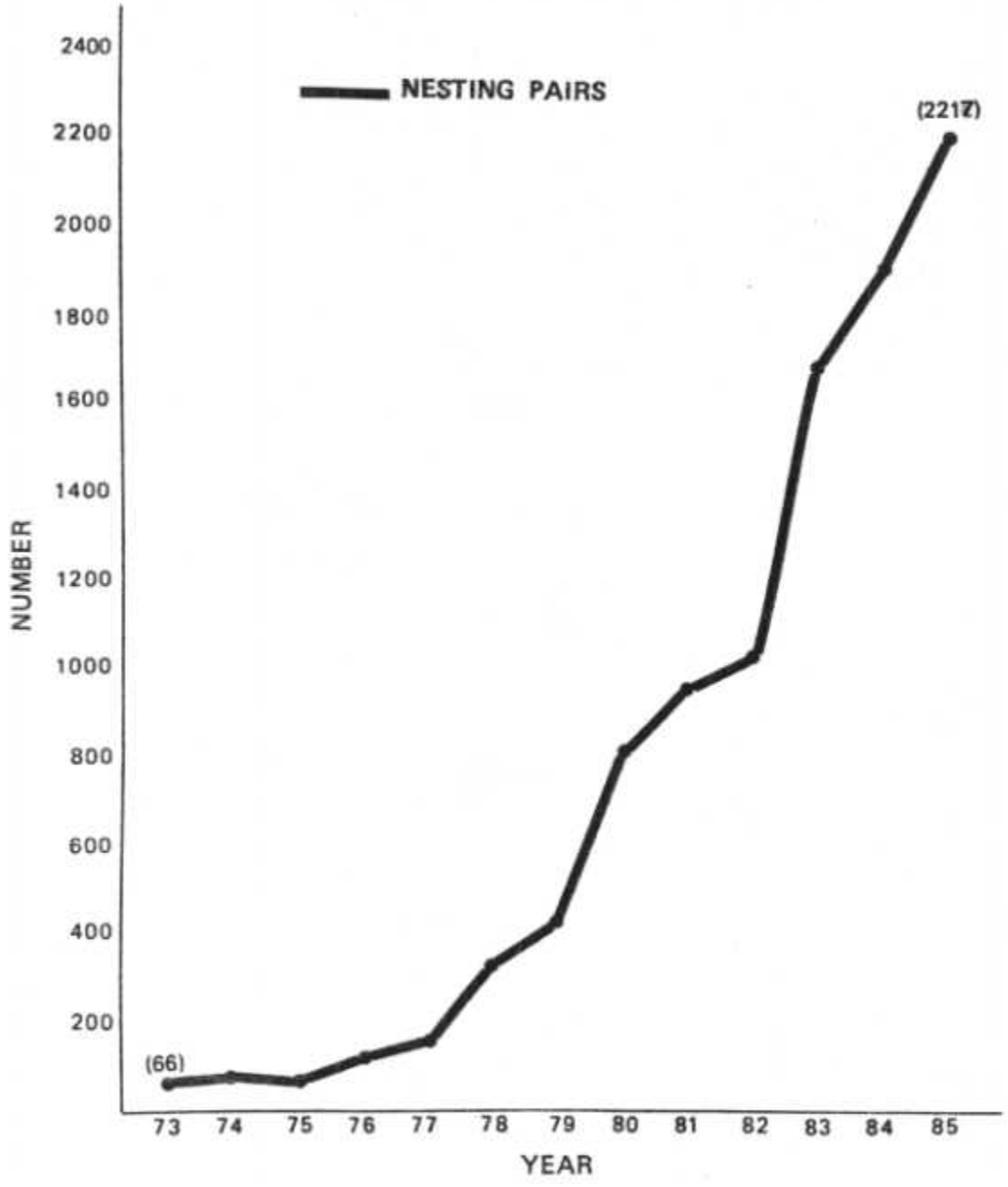


FIGURE 6. Wisconsin double-crested cormorant nesting population trend, 1973-85.

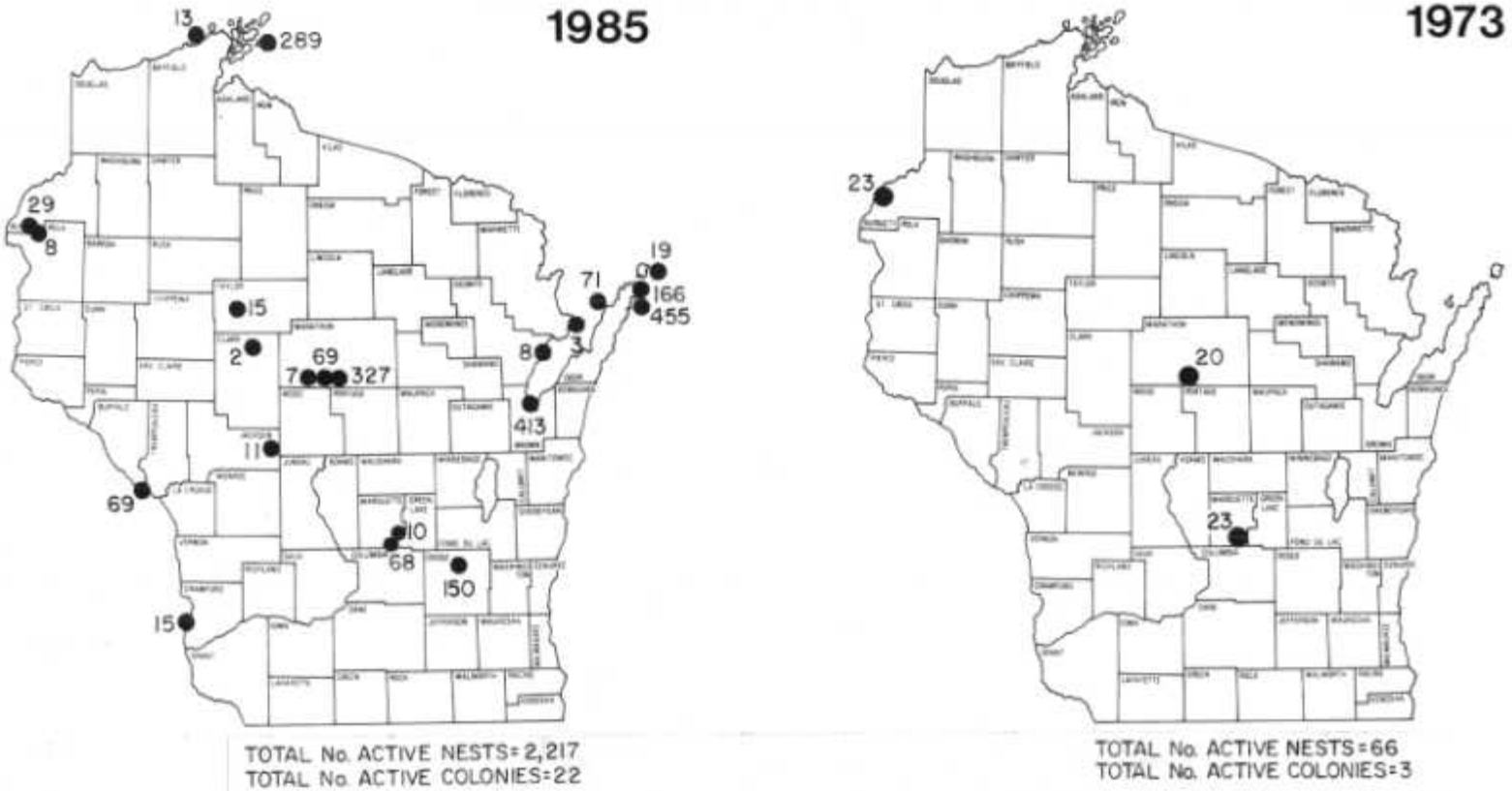


FIGURE 7. A comparison of the distribution of Wisconsin double-crested cormorant colonies in 1973 and 1985.

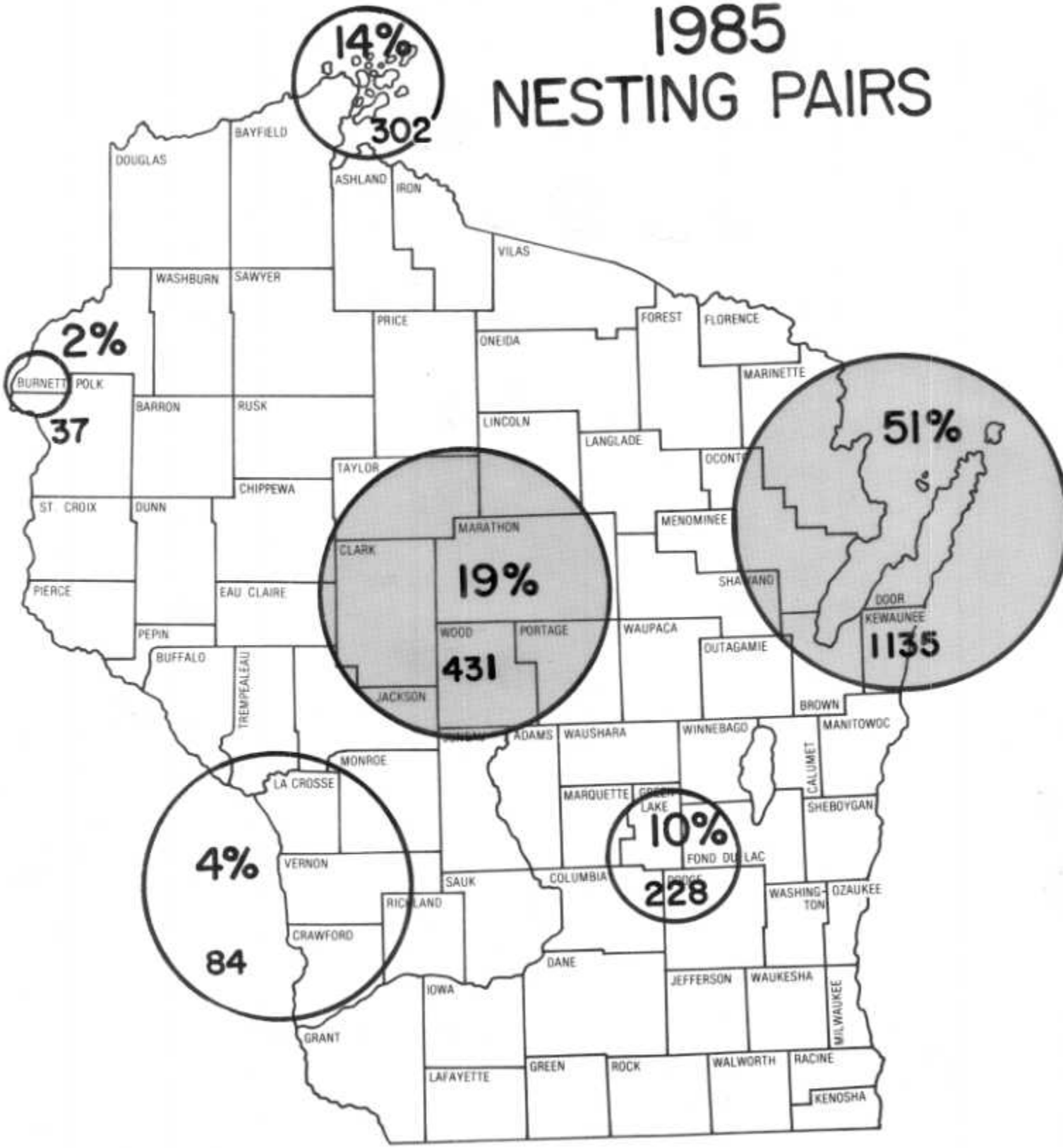


FIGURE 8. Groupings of Wisconsin double-crested cormorant nesting pairs associated with major watersheds or wetlands, 1985.

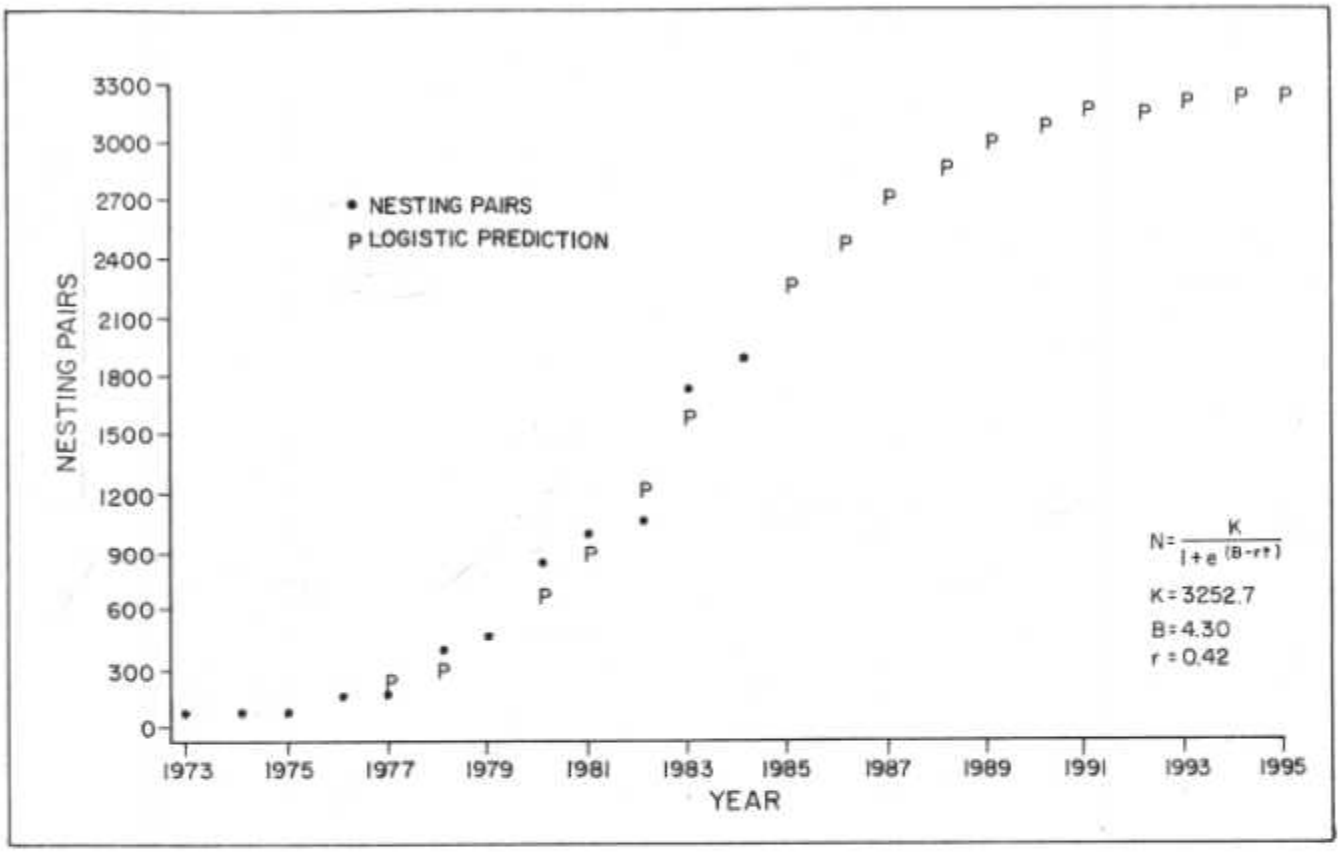


FIGURE 9. Fit of logistic model to Wisconsin double-crested cormorant nesting data, 1973-85

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